We claim:

1. A support system for stabilizing and supporting a base on a stationary surface, the base supporting a device which is moved by a predetermined force, the support system comprising:

at least one bearing to support the base which allows the base to move relative to the stationary surface, the base moving due to at least one of a reaction force and a disturbance force acting on the base, the reaction force being responsive to the predetermined force acting on the device supported by the base; and

at least one actuator to control movement of the base in at least one degree of freedom.

2. The support system of claim 1, wherein the at least one bearing comprises:

one of pneumatic bearings, magnetic bearings, and mechanical bearings, and a combination thereof.

3. The support system of claim 2, wherein the plurality of pneumatic bearings comprise a planar layer of pressurized air to allow the base to move linearly along a first axis and a second axis, and to rotate around a third axis, the first, second, and third axes being orthogonal to each other.

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4. The support system of claim 3, wherein the plurality of pneumatic bearings further comprise a spherical layer pressurized air to allow a top flat surface of each of the plurality of pneumatic bearings to conform to an undersurface of the base.

5. The support system of claim 1, wherein the at least one actuator comprises one of voice-coil motors, planar motors, linear motors, rotary motors with linkages, springs, dampers, and a combination thereof.

6. The support system of claim 5, further comprising:

at least one sensor to detect at least one of an actual position, an actual velocity and an actual acceleration of the base.

7. The support system of claim 6, further comprising:

a control system to determine an error signal for the actuator to generate at least one of a correction force and a correction torque to control the position of the base.

8. The support system of claim 7, wherein the error signal is calculated based on a discrepancy between at least one of the actual position, the actual velocity, and the actual acceleration, and a corresponding predetermined position, predetermined velocity, and predetermined acceleration of the base.

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9. The support system of claim 1, wherein the at least one actuator comprises a first actuator disposed adjacent to the base to generate a first correction force.

10. The support system of claim 9, wherein the at least one actuator further comprises a second actuator disposed adjacent to the base to generate a second correction force.

11. The support system of claim 10, wherein the at least one actuator further comprises a third actuator disposed adjacent to the base to generate a correction torque.

12. The support system of claim 10, wherein the first actuator generates the first correction force acting in a first direction, and the second actuator generates the second correction force acting in a second direction.

13. The support system of claim 11, wherein the first actuator generates the first correction force acting in a first direction passing through a center of gravity of the base, and the second actuator generates the second correction force acting in a second direction passing through the center of gravity of the base, and the third actuator generates a correction torque around a third direction.

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14. A projection lens assembly comprising the support system of claim 1.

15. An object on which an image has been formed by the projection lens assembly of claim 14.

16. A lithography system comprising the projection lens assembly of claim 14.

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17. A stage assembly for manufacturing semiconductor wafers, comprising:

a stage to position at least one substrate, the stage being moved by a first member of a force generator in response to a wafer manufacturing control system;

a base supporting the stage, the base being allowed to move in response to a reaction force generated by a second member of the force generator;

at least one bearing to support the base allowing the base to move relative to a stationary surface; and

at least one actuator to control movement of the base, the movement being caused by at least one of a disturbance force and a reaction force.

18. The stage assembly of claim 17, wherein the stage and the base move in opposite directions and travel inversely proportionate distances corresponding to a stage mass and a base mass.

19. The stage assembly of claim 18, wherein a combined center of gravity of the stage and the base remains stationary.

20. The stage assembly of claim 17, wherein the at least one bearing comprises one of a plurality of pneumatic bearings, magnetic bearings, and mechanical bearings, and a combination thereof.

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21. The stage assembly of claim 20, wherein the plurality of pneumatic bearings comprise:

a first layer of pressurized air to allow the base to move linearly along a first axis and a second axis, and to rotate around a third axis, the first, second, and third axes being orthogonal to each other.

22. The stage assembly of claim 21, wherein the plurality of pneumatic bearings further comprise:

a second layer of pressurized air to allow a top flat surface of each of the plurality of pneumatic bearings to conform to an undersurface of the base.

23. The stage assembly of claim 17, wherein the at least one actuator comprises one of a plurality of voice-coil motors, planar motors, linear motors, rotary motors with linkages, springs, dampers, and a combination thereof.

24. The stage assembly of claim 17, further comprising:

a sensor to detect at least one of an actual position, an actual velocity, and an actual acceleration of the base.

25. The stage assembly of claim 24, further comprising:

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a control system to determine an error signal for the at least one actuator to generate a correction force to cancel the at least one of the disturbance force and the reaction force.

26. The stage assembly of claim 25, wherein the error signal is calculated based on a discrepancy between at least one of the actual position, the actual velocity, and the actual acceleration, and a corresponding predetermined position, predetermined velocity, and predetermined acceleration of the base.

27. The stage assembly of claim 17, wherein the base has at least one degree of freedom, and the at least one actuator is capable of constraining the movement of the base in at least one degree of freedom.

28. The stage assembly of claim 27, wherein the at least one actuator comprises:

a first actuator disposed adjacent to the base to generate a first correction force.

29. The stage assembly of claim 28, wherein the at least one actuator further comprises:

a second actuator disposed adjacent to the base to generate a second correction force.

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~~30. The stage assembly of claim 29, wherein the at least one actuator further comprises:~~

~~a third actuator disposed adjacent the base to generate a correction torque.~~

31. The stage assembly of claim 29, wherein the first actuator generates the first correction force acting in a first direction, and the second actuator generates the second correction force acting in a second direction.

Sub A4

~~32. The stage assembly of claim 30, wherein the first actuator generates the first correction force acting in a first direction passing through a center of gravity of the base, and the second actuator generates the second correction force acting in a second direction passing through the center of gravity of the base, and the third actuator generates a correction torque around a third direction.~~

33. A projection lens assembly comprising the stage assembly of claim 17.

34. An object on which an image has been formed by the projection lens assembly of claim 33.

35. A lithography system comprising the projection lens assembly of claim 33.

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36. A stage assembly for manufacturing semiconductor wafers, comprising:

a stage to position at least one substrate, the stage being moved in accordance with a wafer manufacturing control system;

a base supporting the stage, the base being allowed to move in response to a reaction force generated by a movement of the stage;

at least one bearing to allow the base to levitate above a stationary surface; and

at least one actuator to control movement of the base, the movement being caused by at least one of a disturbance force and a reaction force.

37. The stage assembly of claim 36, wherein the stage and the base move in opposite directions traveling inversely proportionate distances corresponding to a stage mass and a base mass.

38. The stage assembly of claim 37, wherein a combined center of gravity of the stage and the base remains stationary.

39. The stage assembly of claim 36, wherein the at lease one bearing comprises:

one of a plurality of pneumatic bearings, magnetic bearings, and mechanical bearings, and a combination thereof.

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40. The stage assembly of claim 39, wherein the plurality of pneumatic bearings comprise:

a first layer of pressurized air to allow the base to move linearly along a first axis and a second axis, and to rotate around a third axis, the first, second, and third axes being orthogonal to each other.

41. The stage assembly of claim 40, wherein the plurality of pneumatic bearings further comprise:

a second layer of pressurized air to allow a top flat surface of each of the plurality of pneumatic bearings to conform to an undersurface of the base.

42. The stage assembly of claim 36, wherein the at least one actuator comprises:

one of a plurality of voice-coil motors, planar motors, linear motors, rotary motors with linkages, springs, dampers, and a combination thereof.

43. The stage assembly of claim 36, further comprising:

at least one sensor to detect at least one of an actual position, an actual velocity, and an actual accleration of the base.

44. The stage assembly of claim 43, further comprising:

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a control system to determine an error signal for the at least one actuator to generate at least one of a correction force and a correction torque to control the position of the base.

45. The stage assembly of claim 44, wherein the error signal is calculated based on a discrepancy between at least one of the actual position, the actual velocity, and the actual acceleration, and a corresponding predetermined position, predetermined velocity, and predetermined acceleration of the base.

46. The stage assembly of claim 36, wherein the base has at least one degree of freedom, and the at least one actuator is capable of constraining the movement of the base in at least one degree of freedom.

47. The stage assembly of claim 46, wherein the at least one actuator comprises:

a first actuator disposed adjacent to the base to generate a first correction force.

48. The stage assembly of claim 47, wherein the at least one actuator further comprises:

a second actuator disposed adjacent to the base to generate a second correction force.

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49. The stage assembly of claim 46, wherein the at least one actuator further comprises:

a third actuator disposed adjacent to the base to generate a correction torque.

50. A projection lens assembly comprising the stage assembly of claim 36.

51. An object on which an image has been formed by the projection lens assembly of claim 50.

52. A lithography system comprising the projection lens assembly of claim 50.

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53. A method for reducing a vibration force transmitted by a base to a stationary surface, comprising the steps of:

supporting the base and levitating the base above the stationary surface so that the base can move relative to the stationary surface; and

controlling movement of the base in at least one degree of freedom, the movement being caused by at least one of a disturbance force and a reaction force.

54. The method of claim 53, wherein the supporting step comprises:

providing one of a pneumatic support, a magnetic support, a mechanical support, and a combination thereof.

55. The method of claim 54, wherein the step of providing a pneumatic support further comprises:

generating a first layer of pressurized air to allow the base to move linearly along a first axis and a second axis, and to rotate around a third axis, the first, second, and third axes being orthogonal to each other.

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56. The method of claim 55, wherein the step of providing a pneumatic support further comprises:

generating a second layer of pressurized air to allow a top flat surface of each of the plurality of pneumatic support to conform to an under surface of the base.

57. The method of claim 43, wherein the controlling step comprises:

detecting at least one of an actual position, an actual velocity, and an actual acceleration of the base in at least one degree of freedom.

58. The method of claim 57, wherein the controlling step further comprises:

determining at least one error signal based on a discrepancy between at least one of the actual position, the actual velocity, and the actual acceleration, and a corresponding predetermined position, predetermined velocity, and predetermined acceleration of the base.

59. The method of claim 58, wherein the controlling step further comprises:

generating at least one of a correction force and a correction torque corresponding to the at least one error signal to counteract at least one of the disturbance force and the reaction force.

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60. The method of claim 59, wherein the controlling step further comprises generating a first correction force parallel to a first axis.

61. The method of claim 60, wherein the controlling step further comprises: generating a second correction force parallel to a second axis.

62. The method of claim 61, wherein the controlling step further comprises: generating a correction torque rotating around a third axis, the first, second and third axes being orthogonal to each other.

63. The method of claim 62, wherein the first and second correction forces act through a center of gravity of the base.

64. An operating method of an exposure apparatus to transfer a pattern of a mask onto a substrate, the apparatus having a projection optical system, a first stage arranged to be movable on a base with respect to the projection optical system for mounting said mask thereon, and a second stage arranged to be movable with respect to the projection optical system for mounting said substrate thereon; the operating method uses the method of claim 53 when said first stage is driven.

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65. An operating method of an exposure apparatus to form an image onto a substrate, the apparatus having an optical system and a substrate stage arranged to be movable on a base with respect to the optical system for mounting said substrate thereon; the operating method uses the method of claim 53 when said substrate stage is driven.

66. A method for making an object including at least the photolithography process, wherein the photolithography process utilizes the method of operating an exposure apparatus of claim 64.

67. A method for making an object including at least the photolithography process, wherein the photolithography process utilizes the method of operating an exposure apparatus of claim 65.

68. The support system of claim 1, wherein the at least one actuator comprises a first unit connected to the base and a second unit connected to the stationary surface, the second unit being connected to the first unit magnetically.

69. The support system of claim 68, wherein the at least one actuator generates a driving force by utilizing a magnetic field.

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70. The support system of claim 69, wherein the at least one actuator generates a driving force by utilizing a Lorentz force.

71. The support system of claim 70, wherein the at least one actuator comprises one of a voice coil motor, a planar motor, and a linear motor.

72. The support system of claim 71, wherein the at least one actuator comprises a first unit connected to the base and a second unit connected to the stationary surface, the second unit being connected to the first unit magnetically.

73. The support system of claim 72, wherein the at least one actuator generates a driving force by utilizing a magnetic field.

74. The support system of claim73, wherein the at least one actuator generates a driving force by utilizing a Lorentz force.

75. The support system of claim 74, wherein the at least one actuator comprises one of a voice coil motor, a planar motor, and a linear motor.

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76. The stage assembly system of claim 36, wherein the at least one actuator comprises a first unit connected to the base and a second unit connected to the stationary surface, the second unit being connected to the first unit magnetically.

77. The stage assembly of claim 76, wherein the at least one actuator generates a driving force by utilizing a magnetic field.

78. The stage assembly of claim 77, wherein the at least one actuator generates a driving force by utilizing a Lorentz force.

79. The stage assembly of claim 78, wherein the at least one actuator comprises one of a voice coil motor, a planar motor, and a linear motor.

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